

REMARKS

The Final Office Action mailed July 16, 2001, has been received and reviewed. Claims 33 through 37 and 41 through 56 are currently pending in the application. Claims 33 through 37 and 41 through 56 stand rejected. Applicants propose to amend claims 33 through 37 and 41 through 56 , and respectfully request reconsideration of the application as proposed to be amended herein.

I. PTO-1449

An Information Disclosure Statement was filed herein on August 27, 1999, but no copy of the *first page* of the PTO-1449 was returned with the outstanding Office Action. A second copy of the PTO-1449 was mailed with our Response on May 30, 2001. Another copy is enclosed herewith for your convenience. It is respectfully requested that all the information cited on the PTO-1449 be made of record herein and that an initialed copy of the entire PTO-1449 be returned to the undersigned attorney.

II. 35 U.S.C. § 103(a) Obviousness Rejections

Obviousness Rejection Based on U.S. Patent No. 5,672,542 to Schwiebert et al.

Claims 33 through 37 and 41 through 56 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Schwiebert et al. (U.S. Patent No. 5,672,542). Applicants respectfully traverse this rejection, as hereinafter set forth.

M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, **the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on

applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (Emphasis added).

Applicants incorporate by reference the arguments made in our earlier response with respect to these rejections. While Applicants respectfully submit that the claims are allowable as they were previously presented, Applicants propose to amend the claims herein for the purpose of expediting the allowance of the claims. These amendments are made without prejudice and Applicants reserve the right to pursue the prior version of these claims in a related application.

Independent claim 33 is proposed to be amended herein to include an additional element that is not found in U.S. Patent No. 5,672,542 to Schwiebert et al. By this amendment, the claim now includes the element of the least one open aperture being configured to define a peripheral shape of the conductive structure to be formed therein. Support for this amendment may be found at page 11, lines 5 and 6, and elsewhere in the specification.

As discussed in the specification, one of the possible advantages of the present invention is the ability to use the non-metallic mask to determine the peripheral shape of the conductive structures. In prior art removable solder masks, any apertures formed therein are necessarily larger than the conductive structures to be positioned thereby, facilitating removal of such solder masks over the conductive structures. This limits the shape of the conductive structures to solder balls that will coalesce within the aperture without contacting the solder mask. Consequently, the apertures through such a solder mask cannot define the peripheral shape of conductive structure to be positioned thereby. The Schwiebert et al. system suffers from this same shortcoming.

Schwiebert et al. requires an opening within the removable mask that is large enough to allow the mask to be removed from the substrate without interference from the conductive structure. A solder ball is formed within the opening by refluxing solder particles contained therein. As shown in Schwiebert et al. FIG. 1B, a bump to mask distance C remains between the solder ball and the mask aperture wall. A formula for calculating an appropriate bump to mask difference of C is given at column 5, lines 48-53, of Schwiebert et al. Alternative apertures listed

by Schwiebert et al. have non-vertical tapered sidewalls to further improve this release, see Schwiebert et al. column 6, lines 19-20. Schwiebert et al. is thus limited to forming solder balls with a globe shape and which are spaced apart from the mask by a distance C.

By contrast, the present invention may be used to form conductive structures having any desired peripheral shape. Examples of such peripheral shapes are disclosed in FIGS. 5, 6, 7 and 8 as well as throughout the specification of the present application.

Applicants respectfully submit that claim 33, as proposed to be amended, and claims 34-42 dependent therefrom, include elements that are not present in, taught by, or suggested in Schwiebert et al. Applicants request that the proposed amendment to claim 33 be entered and that claims 33-42 be allowed.

It is proposed that independent claim 43 be similarly amended to include an additional element that is not found in U.S. Patent No. 5,672,542 to Schwiebert et al. By this proposed amendment, the claim would include the element of the least one open aperture being configured to define a peripheral shape of a conductive structure to be formed therein. Support for this amendment may be found at page 11, lines 5 and 6, and elsewhere in the specification.

As discussed above, by this proposed amendment, the claim would include elements not taught or suggested in Schwiebert et al., which is limited to forming globular solder balls spaced at a distance from the mask. By contrast the present invention may be used to form conductive structures having any desired peripheral shape. Examples of such peripheral shapes are disclosed in FIGS. 5, 6, 7 and 8, as well as throughout the specification of the present application.

Applicants respectfully submit that claim 43, as proposed to be amended herein, and claims 44-48 dependent therefrom, include elements that are not present in, taught by, or suggested in Schwiebert et al. Applicants request these proposed claim amendments be entered and that claims 43-48 be allowed.

As with claims 33 and 43, it is proposed that independent claim 49 be amended to include an additional element that is not found in U.S. Patent No. 5,672,542 to Schwiebert et al. By this amendment, the claim now includes the element of the least one open aperture being configured

to define a peripheral shape of the conductive structure to be formed therein. Support for this amendment may be found at page 11, lines 5 and 6, and elsewhere in the specification.

As discussed above, by this proposed amendment, the claim would include elements not taught or suggested in Schwiebert et al., which is limited to forming globular solder balls spaced at a distance from the mask. By contrast, the presently claimed invention may be used to form conductive structures having any desired peripheral shape. Examples of such peripheral shapes are disclosed in FIGS. 5, 6, 7 and 8, as well as throughout the specification of the present application.

Applicants respectfully submit that claim 49, as proposed to be amended, and claims 50-56 dependent therefrom, include elements that are not present in, taught by, or suggested in Schwiebert et al. Applicants request the proposed amendments be entered and that claims 49-56 be allowed.


ENTRY OF AMENDMENTS

The proposed amendments to claims 33 through 37 and 41 through 56 above should be entered by the Examiner because the amendments are supported by the as-filed specification and drawings and do not add any new matter to the application. Further, the amendments do not raise new issues or require a further search. Finally, if the Examiner determines that the amendments do not place the application in condition for allowance, entry is respectfully requested upon filing of a Notice of Appeal herein.

CONCLUSION

Claims 33 through 37 and 41 through 56 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, he is respectfully invited to contact Applicants' undersigned attorney.

Respectfully Submitted,



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BGP/BLC/hlg:djp

Enclosure: Version With Markings to Show Changes Made



Serial No. 09/385,584

VERSION WITH MARKINGS TO SHOW CHANGES MADE

Please amend the claims as follows:

33. (Amended) A pre-formed solder mask, comprising:
a layer of non-metallic solder mask material having a substantially uniform thickness; and
at least one open aperture formed through said layer and located correspondingly to a contact pad
location of a substrate upon which the pre-formed solder mask is to be disposed, said at
least one open aperture configured to define a peripheral shape of a conductive structure
to be formed on said contact pad.

35. (Amended) The pre-formed solder mask of claim 33, wherein said substantially
uniform thickness of said layer substantially corresponds to a desired height of [a] said
conductive structure[to be formed on said contact pad].

42. (Amended) The pre-formed solder mask of claim 33, further comprising an
adhesive on a surface of said layer.

43. (Amended) A pre-formed solder mask, comprising:
a layer of non-metallic solder mask material having a substantially uniform thickness, said layer
including a surface configured to be adhered to a substrate; and
at least one open aperture formed through said layer and located correspondingly to a contact pad
location of a substrate upon which the pre-formed solder mask is to be disposed, said at
least one open aperture configured to define a peripheral shape of a conductive structure
to be formed on said contact pad.

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45. (Amended) The pre-formed solder mask of claim 43, wherein said substantially uniform thickness of said layer substantially corresponds to a desired height of [a] said conductive structure [to be formed on said contact pad].

49. (Amended) A semiconductor device assembly, comprising:
a substrate including at least one contact pad;
a pre-formed layer of non-metallic solder mask material disposed on said substrate, said pre-formed layer having a substantially uniform thickness; and
at least one open aperture formed through said pre-formed layer and located correspondingly to said at least one contact pad, said at least one open aperture configured to define a peripheral shape of a conductive structure to be formed therein.